Japan Renewable Energy Foundation

Feed-in tariff scheme in Spain

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MARCH 2012
INSTALLED WIND POWER:
21.673 MW AT THE END OF 2011
MAXIMUM PEAK LOAD 2011: 44.000 MW

Source: AEE
CRITICAL ELEMENTS OF THE REGULATORY FRAMEWORK

**SUFFICIENT:**
Remuneration must allow a suitable level of profitability measured in terms of the cost of capital (WACC).

**PREDICTABLE:**
It must guarantee the volume of income over the life of the installation.

**SUSTAINABLE:**
Feed-in tariffs, tax incentives or other pay schemes must be soundly-based in the long term.

**INTEGRATED:**
It must include guidance facilitating the integration of wind energy in the electrical system.
REGULATORY FRAMEWORKS SHOULD COVER THE PRESENT COSTS OF PRODUCING WIND POWER

LCOE (€/MWh) IN DIFFERENT WIND FARMS CONDITIONS

<table>
<thead>
<tr>
<th>Nominal hours (CAPEX 1,2 MM€/MW)</th>
<th>100% Equity</th>
<th>80% debt / 20% equity (r: 6,5%)</th>
<th>80% debt / 20% equity (r: 7,5%)</th>
<th>Average pool price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1700</td>
<td>1485</td>
<td>1120</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>1900</td>
<td>1325</td>
<td>980</td>
<td>935</td>
<td>935</td>
</tr>
<tr>
<td>2100</td>
<td>1200</td>
<td>880</td>
<td>869</td>
<td>869</td>
</tr>
<tr>
<td>2300</td>
<td>1090</td>
<td>810</td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td>2500</td>
<td>1000</td>
<td>740</td>
<td>735</td>
<td>735</td>
</tr>
<tr>
<td>2700</td>
<td>935</td>
<td>680</td>
<td>675</td>
<td>675</td>
</tr>
<tr>
<td>2900</td>
<td>869</td>
<td>630</td>
<td>625</td>
<td>625</td>
</tr>
</tbody>
</table>

The table provides the Levelized Cost of Energy (LCOE) in different wind farms conditions for various nominal hours and CAPEX values. The graph illustrates the LCOE trend with interest rates varying from 6.5% to 7.5%. The regulatory frameworks should cover the present costs of producing wind power.
Key parameters

Main comments

1. **CAPEX**
   - WTG costs.
   - BOP costs
   - The size in MW should not be the main economic criteria for selecting a WTG
   - Known margins could affect to the final price of the WTG

2. **Generation**
   - Accurate evaluation of the wind conditions and WTG type.
   - Curtailments risks
   - It is important to have an accurate evaluation of the wind conditions for all WTGS
   - Important also an adequate selection of the model and type of the WTGs

3. **OPEX**
   - Maintenance and operation
   - Rents, taxes and social returns
   - As low as possible without affecting Wind Farm Reliability.
   - Impact of local and regional restrictions

4. **Tariff**
   - Initial value
   - Duration and up-dating
   - Technical incentives
   - It should give enough medium and long term vision
   - It has to take into account the learning curve of the technology.

4. **Capital cost (WACC)**
   - Leverage level
   - Rate of interest
   - Country risk
   - It should be based in the sector average, which is often not easy to evaluate.

**KEY PARAMETERS TO DEFINE THE TARIFF INCENTIVE**
THE WACC DETERMINES THE MINIMUM PROJECT IRR

WACC comparison of different Spanish companies of the sector 2010 (1)

<table>
<thead>
<tr>
<th>Company</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iberdrola Renovables</td>
<td>6.7%</td>
</tr>
<tr>
<td>EDP Renovables</td>
<td>6.6%</td>
</tr>
<tr>
<td>Acciona</td>
<td>6.7%</td>
</tr>
<tr>
<td>España (BPI)</td>
<td>6.4%</td>
</tr>
</tbody>
</table>

Minimum project IRR requested a spread of 200 bp over the WACC

(1) Source: Goldman Sachs, Natixis, Bank of America, Exane BNP Paribas, Macquarie, Credit Suisse, BES, RBS, Fidentiis, JP Morgan, BPI, Berenberg Bank
CAPEX IS CRUCIAL IN THE DEFINITION OF A REGULATORY FRAMEWORK

Competition between manufacturers is affecting the final price. Prices of raw materials (steel, iron and copper) have a great influence.

But the starting point is different in several countries.

Source: NREL
MAIN ELEMENTS OF THE SPANISH MODEL

FEED-IN TARIFF
PROMOTING THE INTEGRATION IN THE ELECTRICITY MARKET

Based on the priority of access and feed-in tariff scheme

- Regulated tariff is the same for all wind farms in Spain
- Calculated for an average Wind Farm with 2100 hours of nominal power.
- It allows the project finance of the project.

But it also fosters the participation in the whole sale electric market

- Based on pool price plus a bonus
- All wind farms predict their production for the day-ahead markets.
- They can adjust their generation program in the intra-day market
- Wind farms pay for deviations of their program if they are against system needs,

With some additional incentives for contribution to the technical system operation

- Contribution to voltage control through a bonus for reactive power.
- Old wind farms receive an additional bonus for fulfilling LVRT requirement.
REMUNERATION IN SPAIN AMONG THE LOWEST IN THE EU

Source: EDPR; 2009 data

<table>
<thead>
<tr>
<th>Country</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Francia</td>
<td>83</td>
<td>95</td>
<td>96</td>
<td>78</td>
</tr>
<tr>
<td>Portugal</td>
<td>78</td>
<td>87</td>
<td>98</td>
<td>124</td>
</tr>
<tr>
<td>Alemania</td>
<td>87</td>
<td>98</td>
<td>123</td>
<td>123</td>
</tr>
<tr>
<td>España RD661</td>
<td>83</td>
<td>95</td>
<td>96</td>
<td>78</td>
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<tr>
<td>Polonia</td>
<td>87</td>
<td>98</td>
<td>124</td>
<td>123</td>
</tr>
<tr>
<td>Rumania</td>
<td>98</td>
<td>124</td>
<td>123</td>
<td>123</td>
</tr>
<tr>
<td>Reino Unido</td>
<td>158</td>
<td>124</td>
<td>123</td>
<td>123</td>
</tr>
<tr>
<td>Italia</td>
<td>124</td>
<td>123</td>
<td>123</td>
<td>123</td>
</tr>
<tr>
<td>Bélgica</td>
<td>123</td>
<td>123</td>
<td>123</td>
<td>123</td>
</tr>
</tbody>
</table>

EVOLUTION OF THE REMUNERATION IN SPAIN

Source: EDPR; 2009 data

Regulated tariff

<table>
<thead>
<tr>
<th>Year</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>75,68</td>
</tr>
<tr>
<td>2009</td>
<td>78,18</td>
</tr>
<tr>
<td>2010</td>
<td>77,47</td>
</tr>
<tr>
<td>2011</td>
<td>79,08</td>
</tr>
</tbody>
</table>
CONCLUSIONS

• It is always important to define appropriate tariffs based on actual costs and realistic wind conditions to avoid pressure on the power consumers or tax payers.

• Regulation should include up-dating mechanisms based on the technology learning curve.

• It is also important to incorporate from the beginning guidance facilitating the integration of wind power in the grid and to reduce the cost of regulatory services and balancing power.

• Cooperation between the regulatory body, TSO and Electricity Market operator is recommended to understand the constraints and advantages of the different options and to integrate wind energy at the lowest possible cost.